

ATS. 27/11/1979

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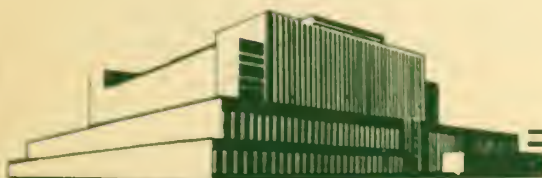
FOREIGN WOOD SERIES



SEN

No. 1979

Revised January 1957



FOREST PRODUCTS LABORATORY  
MADISON 5, WISCONSIN

UNITED STATES DEPARTMENT OF AGRICULTURE  
FOREST SERVICE

In Cooperation with the University of Wisconsin



SEN  
Kalopanax pictus (Thunb.) Nakai  
Family: Araliaceae

By

B. F. KUKACHKA, Forest Products Technologist

Forest Products Laboratory,<sup>1</sup> Forest Service  
U. S. Department of Agriculture

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Introduction

Sen, which is also known as hari-gari, Castor Arabia, and more recently under the copyrighted name "nakora," is a Japanese hardwood belonging to the ginseng family. Sen occurs most commonly in the temperate-zone, mountainous forests in the northern part of Honshu and in all parts of Hokkaido. In deep forests or on fertile ground, the trees may grow to exceptionally large sizes, but they more commonly attain heights of 80 feet and diameters up to 40 inches. Although sen makes up a relatively small volume of the total Japanese hardwood production, it is considered one of the more important species. This species is sometimes sold as Japanese ash, but the name is inappropriate because ash belongs to the genus Fraxinus of the family Oleaceae. References to this species may also be found in the literature under the synonyms Acanthopanax ricinifolium Seem. and Kalopanax ricinifolium Miq. Although Kalopanax pictus also occurs in China, Manchuria, and Korea, it is imported to the United States only from Japan.

The Wood

The sapwood of sen is white, and the heartwood may be a pale yellowish brown to a grayish brown. There is no sharp line of demarcation between sapwood and heartwood. The figure produced by the large springwood pore zone suggests ash (Fraxinus spp.) when flat sawn or rotary cut and American elm (Ulmus americana L.) in quartered material. The wood is straight grained, lustrous, and similar to ash and American elm in texture.

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<sup>1</sup>Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

## Mechanical Properties

Sen is lighter in weight than either American elm or commercial white ash. At 12 percent moisture content, sen weighs about 28 pounds per cubic foot, American elm about 31 pounds, and ash about 36 pounds. Elm and ash both exceed sen in all strength properties as shown in table 1. On the basis of strength properties, sen is more nearly comparable to red alder (Alnus rubra Bong.), American chestnut (Castanea dentata (Marsh.) Borkh.), and yellow-poplar (Liriodendron tulipifera L.).

## Seasoning and Shrinkage

Sen reportedly shrinks and swells appreciably with changes in moisture content. However, no values are available regarding this property. The wood can be air-seasoned or kiln-dried without difficulty.<sup>2</sup>

## Workability

Sen is rated as being easy to work.<sup>2</sup>

## Finishing

The coarse texture of the springwood pore zone necessitates the use of fillers when a smooth, continuous finish is required.

## Durability

Sen is nondurable and therefore best suited for interior use.

## Uses

In Japan, sen is used in general construction and the manufacture of cabinets, furniture, interior trim, carved items, chests, handles, plywood, musical instruments, boats, and numerous miscellaneous articles.

In the United States, it is used primarily in the form of plywood for paneling and doors.

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<sup>2</sup>Bruce, H. D., Cockrell, R. A., and Cummings, L. J. Properties and Uses of Commercially Important Japanese Woods. Natural Resources Section, General Headquarters, SCAP, Report No. 147, October 1951.

## Supplies and Production

According to a 1949 survey,<sup>2</sup> sen stumpage on Hokkaido island amounted to 467 million cubic feet. In Hokkaido, sen veneer makes up 21 percent of the native hardwood veneer production and 30 percent of the plywood produced. The 1950 production of sen veneer amounted to 60 million square feet in Hokkaido alone. About 70 percent of the 1,200,000 board-feet of sen lumber exported in 1950 came to the United States, and the remainder went to South Africa and Europe.

## Price Range

Sen is in the medium price range.

## Identifying Characteristics

	<u>Sen</u>	<u>American elm</u>	<u>White ash</u>
Heartwood color	Pale yellowish brown to grayish brown	Brown	Brown
Springwood pore zone	Single row	Single row	Several rows
Summerwood pores	In wavy tangen- tial lines	In wavy tangen- tial lines	In short radial groups
Vessel elements	Without spirals	With spirals	Without spirals

Commercial white ash can ordinarily be separated from sen because of the wider zone of springwood in ash. American elm and sen can be readily confused, particularly if the wood surface has been modified by bleaching, staining, and finishing. For accurate separation of elm and sen, it is usually desirable to examine the wood microscopically. The presence of spiral thickenings in the vessel elements indicates elm, and their absence sen.

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<sup>2</sup>Forest Products Research Institute. An Outline of Hokkaido Forestry.  
Forest Products Research Institute, Hokkaido, Japan. August 1952.

Table 1.--Strength properties of sen compared with American  
elm and commercial white ash<sup>1</sup>

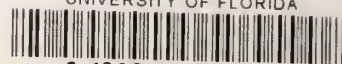
	Sen	American elm	Commercial white ash
Moisture content.....percent:	12	12	12
Specific gravity.....	0.45	0.50	0.58
Static bending			
Fiber stress at elastic limit.....p.s.i.:	6,860	7,600	8,900
Modulus of rupture.....p.s.i.:	10,560	11,800	14,600
Modulus of elasticity.....1,000 p.s.i.:	1,430	1,340	1,680
Work to proportional limit.....in.-lb./cu. in.:	1.92	2.53	2.68
Work to maximum load.....in.-lb./cu. in.:	9.2	13.0	15.6
Impact bending			
Height of drop causing complete failure (50-pound hammer).....in.:	26	39	40
Compression parallel to grain			
Fiber stress at proportional limit.....p.s.i.:	4,310	4,030	5,580
Maximum crushing strength.....p.s.i.:	6,330	5,520	7,280
Compression perpendicular to grain			
Fiber stress at proportional limit.....p.s.i.:	760	850	1,510
Shear parallel to grain			
Maximum shearing strength.....p.s.i.:	660	1,510	1,920
Hardness			
End.....lb.:	800	1,110	1,680
Side.....lb.:	610	830	1,260

<sup>1</sup>Bruce, H. D., Cockrell, R. A., and Cummings, L. J. Properties and Uses of Commercially Important Japanese Woods. Natural Resources Section, General Headquarters, SCAP, Report No. 147, October 1951.





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